A glimpse under the water-table. The Magdala Harbour bio-archive: An integrated analysis of carpological and faunal data

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The work aims to present the first results of the analysis and identification of vegetal and malacological remains – integrated with data from a micropalaeontological analysis – performed on some sediments of the harbour of the archaeological site of Magdala, on the western coast of the Sea of Galilee (Israel). The research at the site, which was carried out by means of a transdisciplinary approach, has shed a new light on the history of the city and on the geological history of this portion of the coast. As no geoarchaeological studies on specifically lacustrine ancient harbours are available to date, Magdala represents a case study of pivotal importance. The results of the analysis on the materials waterlogged in the harbour sediments – which can be considered a bio-archive – have contributed considerably to the palaeoenvironmental reconstruction. The data that emerges from this preliminary study gives a reasonably clear and well delineated picture of the agrestic environment of Galilee in the Late Hellenistic and Roman period, a period in which the city of Magdala and its harbour achieved their greatest prosperity providing reliable evidence for the existence of a local and regional trade network at this moment of its history.

Parole chiave / Keywords

Archeologia, Magdala, Archeobotanica, Malacologia, Galilea, Geoarcheologia, Ostracodi, Carpologia

Archaeology, Magdala, Harbours, Archaeobotany, Malacology, Galilee, Geoarchaeology, Ostracods, Carpology
1. Introduction*

During the excavations carried out between 2007 and 2012, within the framework of the Studium Biblicum Franciscanum Magdala Project,¹ at the site of Magdala on the western coast of Lake Kinneret (fig. 1), some structures belonging to the harbour of the city were brought to light at approximately 200 m from the present day coastline. The investigations of the sedimentary sequences related to the geoarchaeological history of this portion of the coast, were carried out by a trans-disciplinary equit pe which involved cooperation between the archaeologists of the Magdala Project, the Department of Earth Sciences of the University of Pisa (A. Ribolini, G. Sarti, G. Zanchetta), the Department of Geological, Biological and Environmental Sciences of the University of Bologna (A. Amorosi, V. Rossi, I. Sammartino) and the CEREGE-CNRS, University of Aix Marseille (C. Morhange).²

This work aims to present the first results of the analyses and identification of the carpological and malacological remains, recognised within samples collected along one (F25) of the key trenches exca- vated in the harbour site. The samples were analysed in terms of granulometry, geochemistry, pollen³ and ostracod content and underwent C₁₄ dating in order to reconstruct the late Holocene palaeoenvironmental evolution of the area, the phases of use and abandonment of the harbour and the degree of anthropogenic and natural impact on coastal modifications.⁴

The study of the vegetal remains³ – both microscopical and macroscopical (seeds/fruits, woods) plant parts – found in archaeological contexts contributes to the reconstruction not only of the environmental context of a site by giving information about spontaneous and cultivated plants, and the presence of forests, gardens, humid zones but also about fundamental aspects regarding the anthropization of the area and settlement choices, productive activities such as the transformation of agricultural products, farming, crop and animal husbandry, and diet, storage and conservation systems. More generally archaeopalynology and archaeobotany can provide insights into human-environment relations and climate changes.⁵ In the case of harbours’ macro-remains can derive not only from local vegetation but also from other natural causes like

* A. Lena authored all of the archaeological part and the conclusions; A. Lena and M. Marchesini authored the archaeobotanical part; M. Palmieri authored the malacological part; V. Rossi authored the part regarding the ostracod fauna.

¹ The authors are deeply indebted to the Custody of the Holy Land and the Studium Biblicum Franciscanum (Jerusalem) for having supported the excavations carried out by the Magdala Project under the direction of the late Prof. M. Piccirillo. The results of the investigations conducted in the harbour of Magdala were in part included in the PhD thesis defended by A. Lena at the University L’Orientale of Naples. We are grateful to Silvia Marvelli, Elisabetta Rizzoli, L. Pancaldi and to all the staff of the Palynological and Archaeoenvironmental Laboratory CAA ‘Giorgio Nicoli’ for their aid and patience. A special thank you goes to Stefano De Luca who took on the management of the excavation after the death of Michele Piccirillo and with whom for years we coordinated the fieldwork and the international team, active in various ways in the study of the harbour. The research at the site and the study and publication of the findings from the excavations were authorized in 2009 by the former Dean of the Studium Biblicum Franciscanum Prof. C. Bortini and permission was confirmed in 2016 also by the Dean, Prof. M. Pazzini. The excavations at the site were also permitted by the Israel Antiquities Authority.

² For an in depth description of the excavations and the results of the Magdala Project research please refer among others to De Luca 2009; Lena 2012; Lena 2013a, Lena 2013b; Pacini 2013; De Luca, Lena 2014a; De Luca, Lena 2015; Bauckham, De Luca 2015; Rossi et Al. 2013.

³ For an overview of the different branches of the discipline see also Mercuri et Al. 2014, p. 2. For an overview of the history of the archaeobotanical studies in the Near East see Ramsay, Mueller 2016, p. 2.

⁴ For the palynological evidence of the impact of human activities on the Lake Kinneret environment during the late Holocene, see Baruch 1986; Baruch 1990. For the Bronze to Iron Age period, see also Langgut et Al. 2016; Langgut et Al. 2015 (and the online Appendix by Langutt with the palynological diagram of the Sea of Galilee); Langgut 2013. Preliminary palynological analyses of sediments sampled in a Byzantine cistern below the Synagogue of Horvat Kur provide new data on the character of the local landscape, underlining the importance of carrying out more in depth research in this field (Neumann et Al. 2014). As regards the integration of environmental and archaeological data for the study of the ecological-climate influence on ancient societies of the Near East see Kaniewski et Al. 2008; Kaniewski et Al. 2010; Kaniewski et Al. 2013.

⁵ As regards the integrated archaeobotanical and archaeological research in the study of ancient harbours see also Essert et Al. 2016; Gluščević et Al. 2006; Giardini et Al. 2013; Bertacchi et Al. 2008; Pepe et Al. 2013; Allevato 2016; Ward 2004; Bass 1989; Haldane 1993. For an overview of ancient Italian Roman harbours, please refer to Sadoria 2015.
water courses flowing into the harbour and bringing with them seeds and remains of plants. Moreover seeds could also have fallen from commercial merchandise or be part of the sailors’ diet.⁸

⁸ As regards Israel, the examination of the archaeobotanical remains from the harbour of Caesarea were presented by Ramsay (Ramsay 2010), who underlines the need in archaeobotanical studies to outline a functional model and thus differentiate deposits of trade goods and trash. See also Weiss, Kislev 2004.

2. The harbour as a bio-archive

Because of their nature as artificial structures – even if to different degrees – and built at the intersection between land and water (sea, lakes, rivers) harbours – both natural and constructed – are an extraordinary source of information not only for the palaeoenvironmental and geomorphological reconstruction of coastlines and of adjacent areas but also for the observation and the comprehension of man-
environment adaptation strategies and natural and anthropic processes.

The sedimentary sequences in the harbour constitute an archive that conserves and gives information about modifications of the coastline, climatic variations, sedimentation processes and their influence in a relationship of interaction, and about human action, hazards and possible solutions to risk factors.

The building of the harbour's structures, the human activities and the degree of the harbour's protection and the consequent conditions of low energy reflected, in addition to pollution, in changes of the granulometry of the sediments and the study and comparisons of stratigraphies from different harbours enabled us to distinguish in general three different facies: open beach sands, silt from low energy environments and coarse sands on top of the sequence. Therefore the stratigraphic outline evidences «a shift from natural coastal environment to anthropogenically modified environments, eventually culminating in a semi or complete abandonment of the harbour basin».

The integration between archaeology and geoscience is now a consolidated practice in the study of Mediterranean harbours as a tool to understand where, how and why the harbours evolved in lagoon, fluvial and marine contexts. However no geoarchaeological studies on specifically lacustrine ancient harbours are available to date, with the exception of the ancient lake of Mareotis in Egypt which nonetheless corresponds to a coastal lagoon, rather than a freshwater lake.

Given the pivotal importance of the Magdala harbour as a study case, a holistic, trans-disciplinary approach was implemented in order to highlight the main evolutionary stages of the harbour to interpret both natural and anthropogenic impacts on sedimentation, distinguish the sedimentary sequences, tentatively trace a chronological picture of the phases of use and abandonment of the structures, and offer a hypothesis of reconstruction of coastal progradation.

3. The site and the excavations

The city of Magdala/Tarichea situated on the western coast of Lake Tiberias at the widest point and in proximity to a crossroad of one of the main roads of the region which underlines its importance from a strategic and commercial point of view, constituted one of the main coastal settlements. The foundation of the city – its extension probably reached 9/10 hectares – is normally dated to the conquest of the region by the Hasmonean Aristobulus I in 104 BC. In 54 AD Nero annexed the city and its administrative district to the realm of Agrippa II. The city took part in the First Jewish Revolt and resisted until the summer of 67 when it had to surrender to the Roman legions commanded by Titus.

During the course of the 4th century AD Magdala became a destination for Christian pilgrimage. The pilgrims came to visit the sanctuary that commemorated the place of birth or the house of Mary Magdalene and it was probably due to this that a monastery was built close to the lake shore re-using pre-existing structures. The monastery, which had a church and probably also structures for welcoming pilgrims, had a relatively long life and was still frequented and used during the Islamic period, until the end of the 10th century. Travellers from the Cru-

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10 Marriner, Morhange 2007, pp. 144-5.
11 Marriner, Morhange 2006; Marriner, Morhange 2007, pp. 175-7.
12 Marriner, Morhange 2007, p. 172.
13 Sarti ET AL. 2013, p. 120.
14 Morhange ET AL. 2015.
16 See note 2.
17 For the topography of the site, the toponym and the related sources, please refer to Lena 2012, pp. 28-34; De Luca, Lena 2015, pp. 280-98. As regards the urban character of the settlement, please refer also to De Luca, Lena 2015, p. 327; Leibner 2009. For an overview of the history of the settlement, please refer to De Luca, Lena 2014a, pp. 20-124.
20 J. Vit. 96, 127, 132-54, 156-9, 163-4; BJ 2.573, 596, 599, 632-41.
sader period tell of a large basilica dedicated to Mary Magdalene but no material traces have been found nor any connection established to the Byzantine church. This church had, in fact, been abandoned before 1294 when Ricoldus of Monte di Croce was to express his regret at seeing it reduced to a stable.

The Mamluk period the occupation of the area was probably sporadic while during the Ottoman period a village was built over the remains of the Byzantine monastery mostly with reused material from the ancient buildings of the city.

The modest village, which preserved the name of the ancient city, which in Arabic had become el-Mejdel, was destroyed in 194823. The first archaeological excavations were carried out by Studium Biblicum Franciscanum on the property of the Custody of the Holy Land. The Custody, in fact, had acquired, in 1889, a piece of land in proximity to the area in which the presence of a wall with an apsis had been reported. This was thought to be part of a holy building which was in all probability the basilica of the Byzantine period the historic sources spoke about.

V. Corbo and S. Loffreda from 1971 to 1977 conducted eight archaeological missions at the site, bringing to light structures belonging to the Byzantine monastery, a paved road, an urban square surrounded by four porticos, a porticoed building – that they interpreted as a “mini synagogue” – an urban villa with some rooms adorned with mosaics, a water tower that in a second phase was surrounded by water tanks and from which ran an aqueduct on pillars24. The Israel Antiquity Authority has carried out several rescue excavations in the area of the district of Magdala.25 In particular in 1985 some trenches were dug to the north of the Franciscan property, and in 1991 three two-storey buildings and warehouses dating between the 1st-3rd centuries AD were uncovered. In 1992, in the area over which the Byzantine monastery extended the remains of a room paved with a mosaic was discovered, probably a chapel, built on the remains of a thermal facility probably belonging to the Byzantine monastery. In 2002 other surveys were carried out south of the monastery identifying some walls dating to the Crusader period and other findings dating from the Roman to the Medieval period. Another emergency excavation was conducted by the IAA in 2006 along the modern aqueduct that channelled the waters from Tabgha towards Hammat-Tiberias, with the discovery of some remains that could be linked to buildings dating from the Hellenistic period to the ancient Roman period. In 2007 a sounding carried out by the IAA brought to light some structures probably connected to the sugar manufacturing of the Crusader and Mamluk period. Starting from 2009, with the planning of the construction of the Magdala Center of the Legionaries of Christ, north of the Franciscan property, extensive and systematic archaeological excavations were carried out under the direction of D. Avshalom Gorni and A. Najjar of the Israel Antiquities Authority in collaboration with the Universidad Anáhuac México Sur.26 The excavations, which are still underway, have brought to light, among other finds, four residential areas, a road network, some structures close to the lake which are thought to be the remains of a market, some plastered vats, warehouses, an aqueduct and a 1st century synagogue.27 In 2010 some other excavations were performed by the IAA further north of the site, the uncovered remains being ascribable to a period from the Late Hellenistic to the Late Roman period. This indicated «that the excavated area was part of the agricultural land adjacent to the settlement of Migdal».28 In 2007, with the patronage of the Studium Biblicum Franciscanum – the Faculty of Biblical Sciences and Archaeology of Jerusalem - the Magdala Project was instituted with the goal of conducting systematic in depth archaeological investigations in the property of the Custody of the Holy Land.29 In particular the researches, which were carried out until 2012, focused on the dwelling area of the western sector,30 the thermal complex close to the

25 For an updated overview of the excavations carried out in the area and relevant bibliography, please refer to DE LUCA, Lena 2015, pp. 300-2.
26 AVSHALOM-GORNII, NAJJAR 2012; ZAPATA-MEZA 2012.
28 CINAMON 2014.
29 The study of findings and structures is still ongoing.
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During the Early Roman period (first half of the 1st century AD) a thermal complex with a calidarium, a hypocaust system, a praefurnium and a series of stepped pools was in use.

During the Middle and Late Roman periods the thermal complex experienced other changes and restorations. Part of the thermal complex was also building C, misinterpreted as an urban villa, where two first-century mosaics were uncovered: one with a black and white swastika meander and another with the Greek apotropaic motto καὶ σύ and with a figurative panel with the representation of a merchant galley, a dolphin, a kantharos, two

32 De Luca, Lena 2015, p. 305.
33 De Luca, Lena 2015, pp. 303-4.
34 Lena 2012; De Luca, Lena 2014a; De Luca, Lena 2015, pp. 325-6.
tied-up strigiles with a suspended aryballos, a disk for throwing, and a pair of halteres for long jumping and athletic training. \textsuperscript{36}

4. The harbour of Magdala

The harbour structures of the city of Magdala/Tarichea were brought to light between 2008 and 2011 in areas E and F (fig. 3). \textsuperscript{37}

\textsuperscript{36} De Luca, Lena 2014b.

\textsuperscript{37} For an exhaustive description of the structures, see Lena 2012; De Luca, Lena 2014a;

The deep probes F18 and F25 conducted on the eastern perimeter of the quadriporticus F allow the identification of a portion of wall (USM 317) plastered with a thick layer of possibly hydraulic mortar and which incorporated 4 basalt stones (MS 4, MS 5, MS 6 e MS 7 and with the upper side at an average level of – 208.28 m) and with a horizontal hole, interpreted on the base of several comparisons, as mooring stones (fig. 4). The quay USM 317 was built against the eastern wall (USM 282) of the quadriporticus and enclosed the mooring stone MS 1. This, along with the remains of a huge casemate port tower (26×17m) with one mooring stone preo
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Figure 4
General view looking south of the Area F with the Roman Quay, the mooring stones 4-7, the flight of steps and the stone slipway sloping towards the lake (Photograph by V. Sedia, SBF-Magdala Project; cf. Lena 2012, DF Tav. 27)

served in situ (MS 2), suggests the harbour was built in the late Hellenistic period and was conceived together with the foundation of the city.

The covered cloaca E20 separated the quadriporticus F from the tower which originally had its north and east sides facing the water. The sediments GS12 S.2 and GS13 S.2 were sampled along a sequence of dark grey lacustrine silty sand, corresponding to the use of this harbour basin, US 560 in archaeological terms (figs. 5-6).

USM 317 was erected during the Roman period (mid-1st century AD) to reorganise the facilities and provide more mooring places probably for landing, loading and unloading purposes.

Against this quay at approximately 1.5 m from the mooring stones a stone slipway was built slightly sloping toward the lake and from which by a flight of steps, built near the south-eastern corner with three limestone blocks (USM 571), one could access the quadriporticus.

The port tower was demolished and the space was partially occupied by a thermal complex. Against the eastern side a platea was built and the walls enclosing the platea underwent the same surface treatments as wall USM 317. The sloping slipway has been interpreted as a technical solution to accommodate the seasonal fluctuation of the lake. According to the findings, approximately during the second half of the third century, the harbour silted in, as testified to by a layer of natural lacustrine sediments covered by a layer of collapse. The collapse of the structures, probably already in poor condition due to lack of maintenance, could be ascribed to the 363 AD earthquake.

To verify the results of the GPR survey carried out in 2011 to identify possibly anthropic structures...
Figure 5
South section of the trenches F25 e F31 opened respectively against the staircase USM 571 and against the inner south-eastern corner of the quadriporticus F (by S. De Luca, F. Pollastri, SBF-Magdala Project; cf. Lena 2012, DC Tav. 23)

Figure 6
Stratigraphy and vertical distribution of the main ostracod taxa of the key section F25. Samples also analysed for carpological and malacological contents are highlighted in bold. Radiocarbon ages are reported as the highest probability range in calibrated yr BC/AD (slightly modified from Rossi et al., 2015)
and to support the definition of the depositional geometry of the layers which buried some of the structures, trench F27 was opened. Here was unearthed a platform built during the late Roman period about 20 m. from the staircase toward the lake to manage the coastal progradation.

The geoarchaeological integrated approach allowed the identification, in trenches F18, F25 and F27, of three depositional units reflecting – along with the development of the harbour structures – the sedimentary history of the area. The three sedimentary sequences correspond to distinct phases of the harbour’s evolution: 1) pre-harbour sequence; 2) sin-harbour activity sequence; 3) harbour-abandonment sequence.

The abrupt boundary between sequences 1 and 2 is interpreted as the harbour foundation surface (HFS), while the boundary between sequences 2 and 3 corresponds to the harbour abandonment surface (HAS).38

The pre-harbour phase is represented by lacsustrine beach sands lacking archaeological material but rich in ostracod fauna; this level corresponds in F25 to US 562 – at a level between -210.63 e -210.78 m – where just scarce and not diagnostic potsherds were found which suggest a sporadic frequentation of the site (figs. 5-6).

5. The Biological analysis

The filling of the harbour basin, due to its type of deposition environment, is rich in organic material which is generally well conserved by waterlogging in anoxic conditions, lying as it does under the water table, and comprises pollen grains, microcharcoals, seeds, fruits, leaves, wood and charcoals.

The analyses performed on the bio-remain assemblages – ostracods, malacofauna and seeds – from a number of sediments of the harbour of Magdala aim to integrate the archaeological and geoarchaeological results in order to aid the interpretation of the harbour sequences and to complete the picture of the city’s life and of the economy of the area. It offers evidence of land use, and of trade and confirms the picture of Galilee as a highly productive agricultural region. This work, although it is preliminary and needs to be completed with the palynological and ichthyological results, confirms the importance of a transdisciplinary approach and represents a starting point for further research.

5.1 Materials and methods

The examined samples come from trench F25, that is to say from US 562 (sample GS11 S.2) and US 560 (samples GS12 S.2 and GS13 S.2) which represent the pre harbour phase and the phase of use of the harbour area preceding the creation of the Roman dock.

The preparation of the samples was conducted for the ostracodological analyses at the laboratory of the Department of Biological, Geological and Environmental Sciences of the University of Bologna and the vegetal macro remains and the malacological specimens were isolated and gathered at a later stage at the laboratory of Palynology and Archaeobotany CAA G. Nicoli in S. Giovanni in Persiceto (BO).

The initial samples which consisted of 232.1 g (GS11 S.2), 261.3 g (GS12 S.2), 144.6 g (GS13 S.2) of dry sediments were soaked in water or, in the case of the cohesive sediments, water plus hydrogen peroxide (35% vol.), wet sieved through a 63 µm sieve and then dried again in an oven for 24 hours at 60°C. The sample at this stage was dry sieved through a 125 µm sieve.

For the carpological analysis both fractions were examined and the sample was sieved through a 0.2 mm sieve.

The residual part was re-sieved with a 300 µm sieve so not to lose any eventual fragments. The sample was examined also for the archaeozoological remains and the several remains of fish bones identified are now in the process of being studied.

The samples were sorted under a stereo microscope using up to 40 magnification and the carpological and malacofaunal remains were isolated, counted and identified. A fraction from the second sieved part was examined and fragments of fig achenes were counted so as to hypothesize a mini-
maximum number of individuals and then the work proceeded to counting all of the fragments. Some significant carpological remains were photographed through the stereomicroscope. Material was also compared to drawings and pictures in the principal carpological atlases. The identification of the malacofaunal species was performed by using the most recent and complete guide to molluscs of inland waters of Israel, particularly useful were also a comparison with the data concerning the evolution of the malacological population reported by Serruya and the most recently updated data by Zohary concerning the recent modification which affected the malacocenoses of the biotope.

As regards the ecology of the species, taxonomy and nomenclature we referred to the Red List of Threatened Species compiled by the I.U.C.N. – The International Union for the Conservation of Nature.

Carpological spectra were made on the concentration of macro remains in the samples. Given the large number of achenes of Ficus carica it was decided to show the results in two charts: one with the percentages of concentration of the fig seeds (fig. 7) and the other without the percentages (fig. 8).

5.2 Results

Ostracod fauna (fig. 6): The micropalaeontological analysis shows a predominance of the euryhaline opportunistic species *C. torosa* with a basically equal proportion of un-noded and noded valves. This oligotypic ostracod fauna, along with the sedimentological features, indicates a shallow, hypohaline (up to oligohaline) setting with a high-energy, coarse-grained bottom corresponding to the lake-shore area. At the top of the beach sequence a sudden passage from yellow to dark grey sands with some osteological remains, mollusc shells, seeds and potsherds is recorded. Moreover, small-sized, sharp-edged stones of ambiguous (anthropogenic?) origin, mark the boundary between the lake beach deposits, formed under natural conditions, and the overlying harbour succession. The upward slightly increasing trend of *p. albicans*, typical of hypoaline environments points to the likely establishment of slightly more organic-rich, stagnant conditions. This pebble layer, characterised by the same biological content and geochemical features as the overlying harbour unit may reflect the existence of a kind of harbour system which probably included an accumulation of stones lakeward, put in place to facilitate the landing and repair of ships in the Magdala area.

Moving upwards, the abrupt passage to dark fine – very fine silty sands rich in organic material – mollusc shells, seeds, charcoal etc. – records a marked change in hydrodynamic and oxygen conditions (from lacustrine beach to lacustrine bay), occurring at the Harbour Foundation Sequence (HFS). Integrated radiocarbon dating (ca. 170 cal yr BC - 20 cal yr AD) and the study of the findings furnish a consistent age for this harbour fine-grained unit, formed during a chronological interval ranging between the 2nd century BC and the first half of the 1st century AD.

The ostracod fauna is abundant and shows, beyond the dominant species *C. torosa*, an increased number of secondary hypoaline taxa, including *p. albicans*, *Heterocypris salina* and *Ilyocypris* species. A clear predominance – between 75% and 88% – of noded forms of *C. torosa* is also recorded.

The increase in the relative abundance of species preferring stagnant conditions such as *p. albicans*, in comparison with the pre-harbour sandy unit, testifies to a low energy environment (one that was anthropized and possibly artificially protected), where the waterlogged sediments preserved abundant osteological remains, seeds and other vegetal remains and archaeological material. The pottery found in this unit refers to a chronological time span from the 2nd century BC to the first half of the 1st century AD.

For the pottery assemblages from the harbour area please refer to LENA 2012, pp. 86-124; see also ROSSI ET AL. 2014, pp. 9-12.

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40 Milstein et al. 2012.
41 Serruya 1978.
42 Zohary et al. 2014.
44 For the complete procedure and relevant bibliography, please refer to Rossi et al. 2014.
45 For the pottery assemblages from the harbour area please refer to Lena 2012, pp. 86-124; see also Rossi et al. 2014, pp. 9-12.
Moreover, the presence of species usually found in shallow, slightly saline waters (*H. salina e p. albicans*) and the absence of taxa restricted to extremely low salinity-stillwaters indicate remarkable solute concentrations. This is confirmed by the dominance of noded *C. torosa* a dominance which, thanks to integrated ostracod-geochemical analyses (SEM-EDS) is seen as a reflection of changes in the water chemistry. Accordingly, the XRF analysis performed on the sediments highlights an increase of solute concentrations at the transition from the natural, pre-harbour environments to the human-forced bay, i.e. the harbour basin (Rossi et al., 2015). This abrupt human-forced shift towards a higher degree of protection resembles the typical depositional evolution of the Mediterranean ancient harbours, where the
reduced water exchange with the lake basin translates into an increase in organic matter, a decrease in water energy and a change of salinity.

To verify the extension of this sedimentary facies and its relation to the harbour structures, some probes were carried out in other areas of the site. Although the study is still ongoing, on the base of the pottery assemblages and of a preliminary examination of the sediments we can hypothesise that the quadriporticus was planned and built when the bay was already semi-protected.46

In trench F25 this sedimentary facies corresponds, from an archaeological point of view, to the US 560 with the lower boundary at -210.58 and the top at -210.20 m.

Malacofaunal remains: the analysis carried out on the samples shows that only the samples GS11 S.2 and GS12 S.2 contain malacological remains (fig. 9) pertaining to the three species of freshwater gastropods which are typical of the biocenosis of the Lake Kinneret up to the present time: *Melanopsis costata* (Olivier, 1804), *Melanoides tuberculata* (Müller, 1774) and *Theodoxus jordani* (Sowerby, 1832).47

As regards the distribution of the identified species, the *Theodoxus jordani* and the *Melanopsis costata* at the present time occur in western Asia, while the *Melanoides tuberculata*, which originated in southern Asia and Africa, has spread all over Asia, Africa, America, Australia and, recently, Europe, due mainly to anthropogenic reasons such as trade and productive activities.

These three species of freshwater molluscs share a wide ecological valence (high degree of adaptability to the variations in environmental factors) so they have limited informative potential as palaeoenvironmental indicators.

*Melanoides tuberculata* prefers lentic and warm waters with sandy or gravelly substrate and survives even in highly eutrophic environments with strong anthropogenic disturbance; *Melanopsis costata* occurs in several types of freshwater environments, mainly with a non-muddy substrate and with a good rate of oxygenation. Also *Theodoxus jordani* occurs in several kinds of freshwater environments, even if they are highly polluted, but requires a solid substrate.

The aim of the malacological analyses on the samples from the sedimentary sequences of the harbour of Magdala, which are currently on going, is to contribute to the definition and the reconstruction of the environment which characterised the site throughout its life providing, at the same time, data on the evolution of the malacocenosis which characterised Lake Kinneret and the surrounding areas at this time.

For the sake of completeness we decided to present here the preliminary results of the malacological analysis on the samples from trench F25, although the informative value of the remains, in itself moderate, will be relevant only after a full analysis of all the assemblages from the trenches and the corings performed at the site Archaeobotanical remains: the artefacts displayed a good state of conservation which was probably due to anaerobic conditions typical of damp environments.

A total of 4,221 seeds and a total of 20 taxa were identified in the three samples with a decisive increment between sample GS11 S.2 (phase pre harbour) and the two samples GS12 S.2 and GS13 S.2 (phase of use of the late Hellenistic harbour). Of the 20 taxa 4 are related to woody plants and 16 to weed plants. All the samples show a considerable predominance of *Ficus carica* seeds with a percentage of about 98%.

For this reason the percentage of seeds of the other species, were calculated excluding the fig achenes (figs. 7-8).

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46 Lena 2012, p. 131.
47 Zohary et al. 2014, p. 525.
Of the 13 botanical specimens identified in sample GS11 S.2, the highest percentage – without calculating the achenes of *Ficus carica* (fig. 98.18%) (fig. 10) – is represented by *Najas*/naiad (46.15%) and *Potamogeton*/broad-leaved pondweed (7.69%), which are characteristic of a wet environment, followed by the wild and weed species *Chenopodium*/goosefoots (7.69%) (fig. 11). *Coriandrum sativum*/coriander largely used as aromatic and medicinal plant represents 7.69%.

The cereal crops are represented by *Triticum dicoccum*/cultivated emmer wheat (7.69%) (fig. 12) and the fruits by *Vitis vinifera*/grape vine (15.38%). In sample GS12 S.2 the dominant species is *Ficus carica* (98.38%), the next in line of dominances is *Najas* (40.63%) but the second largest cultivated species is represented by *Vitis vinifera* (21.88% seeds, 6.25% pedicels) (figs. 13a-b). Wild wetland species *Cyperaceae*/sedges (9.38%) is followed by *Chenopodium* (3.31%) and *Cerastium*/mouse-ear chickweed (3.13%). The assemblage also gives evidence of legumes represented by *Lens culinaris*/lentil (6.25%) (fig. 14) which, given its high protein content, was indubitably sta-

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example in the ancient diet⁴⁹ and of garden herbs⁵⁰ represented by Coriandrum sativum (3.13%) and the ruderal Hypericum/St. John’s wort (3.13%) also possibly used as medicinal herb.⁵¹ Specimens of sample GS13 S.2, are dominated by Ficus carica (98.37%), followed by the aquatic plants Najas (20%) and Potamogeton (12%); the swamp plant Typha/cattail (4%) which would have been used for fire, for thatching, dyeing,⁵² and the hygrophilous woody plant Salix/willow (4%) completing the assemblage of wet ground plants.⁵³ Of great interest is the presence of Sinapis/mustard (8%),⁵⁴ which was widely used in antiquity in spices and for medicinal purposes, Coriandrum sativus (4%) which confirms the trend of the presence of garden/medical herbs; also the ruderal Verbena officinalis/vervain (4%) which could be collected in the wild for medicinal use. Cereals/cereals (4%) and particularly Panicum milicceum/broomcorn millet⁵⁵ (4%) are represented. The Vitis vinifera is represented at an average of 12%.

The presence of Rubus / blackberry is attested in all the samples.

The percentages show an increase in the indicators of anthropic activities which seems to comply with the transition from a sporadic – but well documented, as shown by the presence of seeds of Coriandrum sativum, Vitis vinifera and Triticum dicoccum – frequentation of the site (GS 11 S.2) possibly as a landing place in a phase of use of the harbour basin (GS 12 S.2, GS 12 S.2). Apart from the properly cultivated species, also the increase in the number of spontaneous anthropic plants, such as Chenopodium, Verbena officinalis, Urtica dioica/common nettle, Hypericum, Rubus points to an anthropized landscape.

Moreover, the continuous presence of aquatic vegetation – Najas, Potamogeton, Typha, Salix – is consistent with a persistent humid habitat and water springs.

The impressive number and the increasing concentration of achenes of Ficus carica⁶⁶ in the sediments corresponding to the filling of the basin, seems to be connected with the drainage of sewer E20 and testifies that covered cloaca had been in use since the first stage of the city life and were to be included within the late Hellenistic layout of the settlement.⁵⁷

6. Conclusions

During the Hellenistic to Roman/Byzantine period the area around the Lake was involved in intensive agricultural activities as testified also by the results of palynological analysis.⁶⁸ The data that emerges from this preliminary study shows a reasonably clear and well delineated picture of the agrestic environment of Galilee of the Late Hellenistic and Roman period, the period in which the city of Magdala and its harbour achieved their greatest prosperity. The rich assemblages of jars of several typologies found in the sediments of the harbour⁶⁹ provide reliable evidence to confirm the existence in this period of a local and regional network of trade in goods transported by small boats from one side of the lake to the other, and represent a starting point for future research on the nature of the trade goods, on their origin and on the agricultural lands under the administrative control of the city. Although the excavations did not establish for certain the existence of warehouses close to the anchorage points, the presence of cereals in the examined assemblages seems to point to the presence of at least commercial products.

It was from such an environment that apocryphal literature and the New Testament took their inspiration. It has even been recently hypothesised that the Book of Enoch – or at least a part of it (the

⁵⁰ Cappers 2006, pp. 84-5.
⁵³ Duke 2008, pp. 404-12. Willow was one of the wood-types used for the hull of the Kinneret boat, found about 7 km to the north of the archaeological site of Magdala. Wachsmann, Davis 2002, p. 505.
so called ‘Book of the Parables’) – was written in Magdala.60 Some passages refer to vegetation and plants and the description of the georgic landscape seems to suggest the panorama of the 1st century BC Galilee, along the coast of the lake: the same landscape as revealed by the results of the archaeobotanical analysis here, Enoch 10:19: «And all the trees of desire will be planted on it, and vines will be planted on it; the vine planted on it will bear fruit in abundance. And of all the seed sown on it one measure will bear ten thousand, and one measure of olives will make ten presses of oil».

During the Hellenistic time, according to literary sources, the region was also known for its rich wine production. The increasing rate of Vitis vinifera seeds from the pre-harbour phase to the proper harbour sediments – where also the remains of pedicels were identified – strongly support this picture.61

Enoch 24:4: «And among them was a tree such as I had never smelt before, neither among these nor among others; nor was there a fragrance like it; its leaves and buds and wood do not wither in eternity; its fruit is beautiful, like the fruit of the vine and the palm-tree».

Enoch 32:4: «It is like the carob tree, and its fruit is like the grape, very good; the fragrance of this tree goes out and is spread far».

To summarize, the author of the Book of Enoch mentions plants commonly widespread in Galilee and the description of the region closely recalls the one offered by Josephus of the Gennesareth Valley «it supplies men with the principal fruits, with grapes and figs continually, during ten months of the year».62

New Testament literature, the Gospels in particular, offer a detailed depiction of the rural landscape and in the passages where Jesus uses parables to convey his message vine and grape, fig, wheat, olive tree and mustard frequently recur.

Also grape, mustard, wheat, fig and olive are frequently mentioned in the books of the New Testament, just as they frequently appear in the results of the examinations of the samples from the excavations of Magdala. In John 15:1 it is written: «I am the true vine (ἡ ἀμπελός ἡ ἀληθινή), and my Father is the vinedresser». Further on in John 15:4 «Abide in me, and I in you. As the branch cannot bear fruit by itself, unless it abides in the vine (ἐν τῇ ἀμπελώ), neither can you, unless you abide in me».

The example of the tree which is recognized by its fruits is also an image commonly used in the New Testament. Matt. 7:16 «You will recognize them by their fruits. Are grapes gathered from thornbushes (ἀπὸ ἀκανθῶν σταφυλάκες), or figs from thistles (ἀπὸ τριβόλων σῦκα)?». Luke 6:44: «for each tree is known by its own fruit. For figs are not gathered from thornbushes, (ἐξ ἀκανθῶν συλλέγουσιν σῦκα), nor are grapes picked from a bramble bush (ἐκ βάτου σταφυλή τριγώστην)». James 3:12a: «Can a fig tree, my brothers, bear olives, (σινάπη ἔλαιος ποιήσαι) or a grapevine produce figs (ἡ ἀμπελός σῦκα)?»

Even the mustard seed is used in the parables: Matt. 13:31 «He put another parable before them, saying, The kingdom of heaven is like a grain of mustard seed (κόκκῳ σίναπεως) that a man took and sowed in his field»; Mark 4:31 «It is like a grain of mustard seed (ὡς κόκκων σινάπεως), which, when sown on the ground, is the smallest of all the seeds on earth»; Luke 13:19 «It is like a grain of mustard seed (κόκκῳ σινάπεως) that a man took and sowed in his garden, and it grew and became a tree, and the birds of the air made nests in its branches»; Matt. 17:20 «He said to them, “Because of your little faith. For truly, I say to you, if you have faith like a grain of mustard seed (ὡς κόκκων σινάπεως), you will say to this mountain, ‘Move from here to there,’ and it will move, and nothing will be impossible for you”»; Luke 17:6 «And the Lord said, “If you had faith like a grain of mustard seed (ὡς κόκκων σινάπεως), you could say to this mulberry tree (τῇ συκαμίνῳ ταύτῃ), ‘Be uprooted and planted in the sea,’ and it would obey you”».

Even more frequently wheat is mentioned: Matt. 3:12 «His winnowing fork is in his hand, and he will clear his threshing floor and gather his wheat (τὸν σίτον αὐτοῦ) into the barn, but the chaff (ἀχυρὸν) he will burn with unquenchable fire»; Luke 3:17 «His winnowing fork is in his hand, to clear his threshing floor and to gather the wheat (τὸν σίτον) into his barn, but the chaff (ἀχυρὸν) he will burn with unquenchable fire»; Matt. 13:25 «But while his men

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60 Aviam 2013b.
62 J. BJ 3.10.8.
were sleeping, his enemy came and sowed weeds among the wheat (τοῦ σίτου) and went away»; Matt. 13:29 «But he said, “No, lest in gathering the weeds you root up the wheat (σίτον) along with them”»; Matt. 13:30b «Gather the weeds first and bind them in bundles to be burned, but gather the wheat (σίτον) into my barn»; Luke 22:31 «Simon, Simon, behold, Satan demanded to have you, that he might sift you like wheat (σίτον)»; John 12:24 «Truly, truly, I say to you, unless a grain of wheat (ὁ κόκκος τοῦ σίτου) falls into the earth and dies, it remains alone; but if it dies, it bears much fruit».

This exposition has thus given evidence to show how the study of vegetal macroremains can contribute to the reconstruction not only of ancient natural and anthropized landscapes but also to dietary habits and, as in Madgala’s case, to economic activities. The existence of commerce and trade at Madgala was certainly favored by its position on the cross roads of the main trade routes of the region and the existence in Magdala of a local thriving market is clearly testified to also by the numismatic evidence.

What we are expecting from the continuation of the work of the rest of the archaeobotanical assemblages is to be able to offer not only something relevant to the definition of the economic and natural landscape of Galilee but also to gain new elements from which to start an investigation of aspects that have not been completely investigated concerning the history of the city.

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63 The Via Maris in Egypt ran along the Mediterranean coast up toward Lebanon until Mount Carmel and then turned inland to the Gezrael Valley continuing north along the western coast of the Lake of Galilee in the direction of Hazor and Damascus, until it reached Mesopotamia. Hezser 2011, pp. 54-5; Lena 2012, p. 29, n. 80; De Luca, Lena 2015, p. 121, n. 46; Strange 2014, pp. 263-71.

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